1996

Emperor Penguins: Heirs to Extremes

Sanjay Gupta

Emperor Penguins: Heirs To Extremes

Sanjay K. Gupta

When winter blacks out Antarctica, temperatures sink to minus 57 degrees Celsius (-70 degrees Fahrenheit), and winds scream over the ice sheets at 200 kilometers an hour (124 mph). So what are 400,000 emperor penguins doing laying eggs and raising chicks at this time of year?

Few creatures have so captured the human heart and imagination as penguins, the waddling, flightless seabirds that dwell in some of the most frigid, inhospitable and inaccessible regions on Earth. The habitat of all of the world's eighteen or so penguin species (scientists disagree over the number) ranges from Antarctica to South Africa, South America, Australia, New Zealand and even as far north as the Galapagos Islands. Yet the emperor penguin, the epitome of adaptation, rules supreme in a kingdom of ice and snow.

Emperor penguins thrive in areas where most animals would quickly perish, supremely well-adapted as they are to life in the deep freeze. The largest of all penguin species and the largest of all diving birds, the emperor is the least agile. Yet the four-feet-tall penguin can manage to leap crevasses in the ice with an incubating egg tucked safely on its feet. In water the emperor can dive as deep as 500 meters and can swim 1,450 kilometers(900 miles)on a foraging trip.

Penguins are aquatic birds, spending most of their lives at sea. Although adapted to their watery domain, penguins rely on land because they are constrained by their evolutionary past to lay eggs; and eggs cannot be laid at sea. Penguins, then, have a dual lifestyle — one that must seek a balance between the need to breed on land and the need to eat at sea, their sole source of sustenance. Breeding for an emperor penguin must of necessity consist of alternating periods of fasting and foraging.

Emperor penguins breed in the most extreme latitudes of Antarctica and have a unique seasonal cycle. Scientists have started to piece together the intriguing behavioral and physiological adaptations that enable the emperors to stay behind when all other birds depart for the winter. Courtship starts in March (fall in the Southern Hemisphere) when emperors swim back to one of about forty colonies scattered along the coast of Antarctica. The colonies stay within traveling distance (dozens of kilometers) of ice edges or polynyas, holes in the ice, where parents can go to feed. Unlike other penguins, females compete for the attention of the males. Pairs court by means of elaborate movements. Males drop their heads to their chests or lift their heads high, puffing out the muscles of their throat

regions. Females perform the same display, and both sexes scream out mating calls, the identifying signatures that allow each penguin to locate his or her mate or chick in a colony of thousands of nearly identically marked birds.

In the breeding season, female penguins slap other females with their flippers or peck at them as they want the biggest and strongest male. Some researchers speculate that this competition is due to a shortage of males. Courtship takes six weeks, during which neither males nor females eat. After mating, the male and female stand quietly beside each other until the female lays a single large white egg which weighs slightly less than a pound.

The female's partner then takes the egg onto his feet and tucks a fold of warm flesh called a "brood pouch" over it. The female leaves immediately for an extended foraging journey and for the next 65 days, until hatching, the male cares for the egg. In other words, the male goes for as many as 115 days without food. Before courtship, the male should weigh 40 kilograms (88 pounds) to have sufficient energy to fast until his mate returns. During the incubation period, one of the more astonishing social behaviors of emperors takes place: huddling. To preserve as much energy as possible, hundreds of penguins lean into a huddle, and, one at a time, eggs still on their feet, sidle inward so that hundreds of emperors continually turn. Each gets a turn at warming up in the center of the mass. If male emperor penguins did not huddle, their metabolic rate would double and they would only be able to survive two months of fasting.

Two other remarkable adaptations help the emperors through these toughest, coldest Antarctic months. One is an elaborate system of veins and arteries that serve the feet and flippers. The blood vessels weave together and wrap around each other in an ingenious heat exchange so that chilled blood returned from extremities captures heat from the blood surging away from the heart. This intricate arrangement of blood vessels minimizes energy loss. Another special adaptation is the emperor's coat. At least four layers of feathers clothe the emperor, almost like scales, overlapping tightly so they cannot be ruffled even by a 100-knot wind. These feathers are denser than those of any other bird and cover the entire body, about 70 per square inch.

The female returns from foraging just when hatching begins. After more than two month's absence, facing thousands of male penguins in the dark, she addresses her unique mating tune and locates her mate. The male by now weighs half of what he did at the beginning of courtship. Should his mate fail to return, he can feed the chick for a week or so on his own protein secretion. After that, he abandons the chick and leaves for the feeding grounds to save himself. Even mothers that do return on time, however, can lose their chicks. In a delicate, life-threatening move that lasts just seconds, the father passes the chick from his feet to his mate's. Should the chick fall during the exchange, it will freeze in two minutes.

Chick napping is a significant cause of death of emperor chicks. Single "female mavericks," as scientists call adults without offspring, wander the colonies fight-

ing for chicks. Parents are extremely motivated to brood something in their brood pouch; some even incubate a chunk of ice, pretending it is an egg. Scientists theorize that brooding ice and Chick napping come from uncontrolled hormones. However, as hormones come back to normal levels, the adoptive mothers desert the chicks they have stolen, sometimes within minutes. The abandoned youngsters will then quickly freeze to death.

For seven weeks after hatching, the parents trade off feeding responsibilities, traveling kilometers to eat squid, small fish and krill that they partially digest and later regurgitate to their chicks. When the young, shaggy, gray emperor joins a creche, the parent may spend 20 days at a time out foraging, traveling from 30 to 1,450 kilometers (20 to 900 miles) for food. When the adult returns, it must sound out its unique call to locate its chick to feed. During the five-month period after hatching, an emperor chick eats 100 kilograms (220 pounds) of food, and in a single feeding may eat one-third of its body weight.

In early December, when the chicks reach five months, the parents leave them, without instructions on swimming or foraging. During the months of December and January, the weather is most pleasant; open water is nearby and the food supply is abundant. Since it takes two months to hatch an egg and at least four months to rear a chick, the emperors must begin to breed during the middle of the Antarctic winter if young are to reach independence by December.

Emperor penguins spend their first years at sea. Not until the birds turn three to five years of age do they start breeding. Some scientists estimate that only 1 percent of adult emperors die each year, often victims of the cruel weather. No one knows for sure how long emperor penguins live, but many believe it to be 30 years or more.

Age is only one of the remaining mysteries about emperors. Questions abound, and scientists seem drawn to the birds despite the rigors of studying them. Soon after the discovery of the species almost 100 years ago, British explorers mounted a special expedition, which repeatedly risked human lives to bring back three emperor eggs to provide evidence of the evolution of feathers. That journey inspired a travel memoir called The Worst Journey in the World. Even the author of the book, Apsley Cherry-Garrard, wrote, "You must agree that a bird like this is an interesting beast."

References

Ancel, A., G. Kooyman, P. Ponganis, J. Gendner, L. Lignon, X. Muestre, N. Huin, P. Thorson, P. Robinson, and Y. Maho. 1992. Foraging behaviour of emperor penguins as a resource detectorin winter and summer. *Nature*. 360:336-339.

Gorman, James. 1990. *Penguins*. Prentice Hall, New York.

Hale, Ellen. 1993. Hail to the emperor. *International Wildlife*. 23(6):44-50.

Nordlander, Charles. 1991. Polar wilderness in peril. *National Geographic World*. (186):22-36.

Reilinger, Diana M. 1991. Tuxedo tango: when penguins get romantic. *Sea Frontiers*. 37(3):26-34.

Roy, Tui De, and C. Dybas. 1991. The sheer wonder of penguins: tales and tidbits about the world's coolest birds. *International Wildlife*. 21(2):4-12.

Schmidt, Rudiger. Dec. 1991. Cold comfort. *World Magazine*. 39-43.